60

Virtual to Physical Memory Address Translation and Protection Table

Virtual Memory Addresses	Physical Memory Addresses
0X1000	⇨ 8AEF000
0X22000	⇨ 4D957000
0X46000	⇨ 88AB42000
0X123000	⇨ DE53C25000

FIG.2
Prior Art

54

Long-Term Physical Memory Space

10c

FIG. 1
Prior Art

52

Physical Memory Space

10a

10b

50

Virtual Memory Space

50a
50d
50b
50c

| Partition No.	Buffer size	Starting Address	Memory Allocation Bitmap 72
Partition A	4KB	0X1000	00000001000000000000000010
Partition B	1KB	0X22000	00000000000000000000000000
Partition C	256KB	0X4600	00000000000000000000000000
•••			
Partition N	128KB	0X123000	00000000000000000000000000

FIG. 3
Prior Art
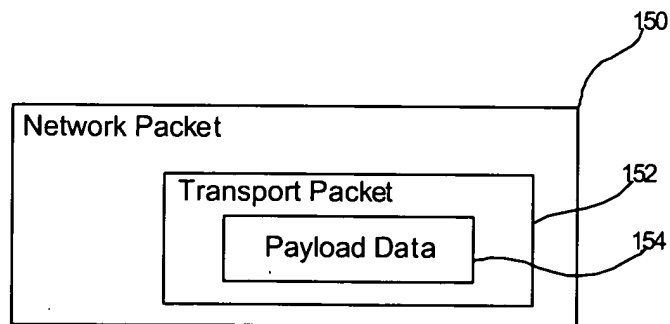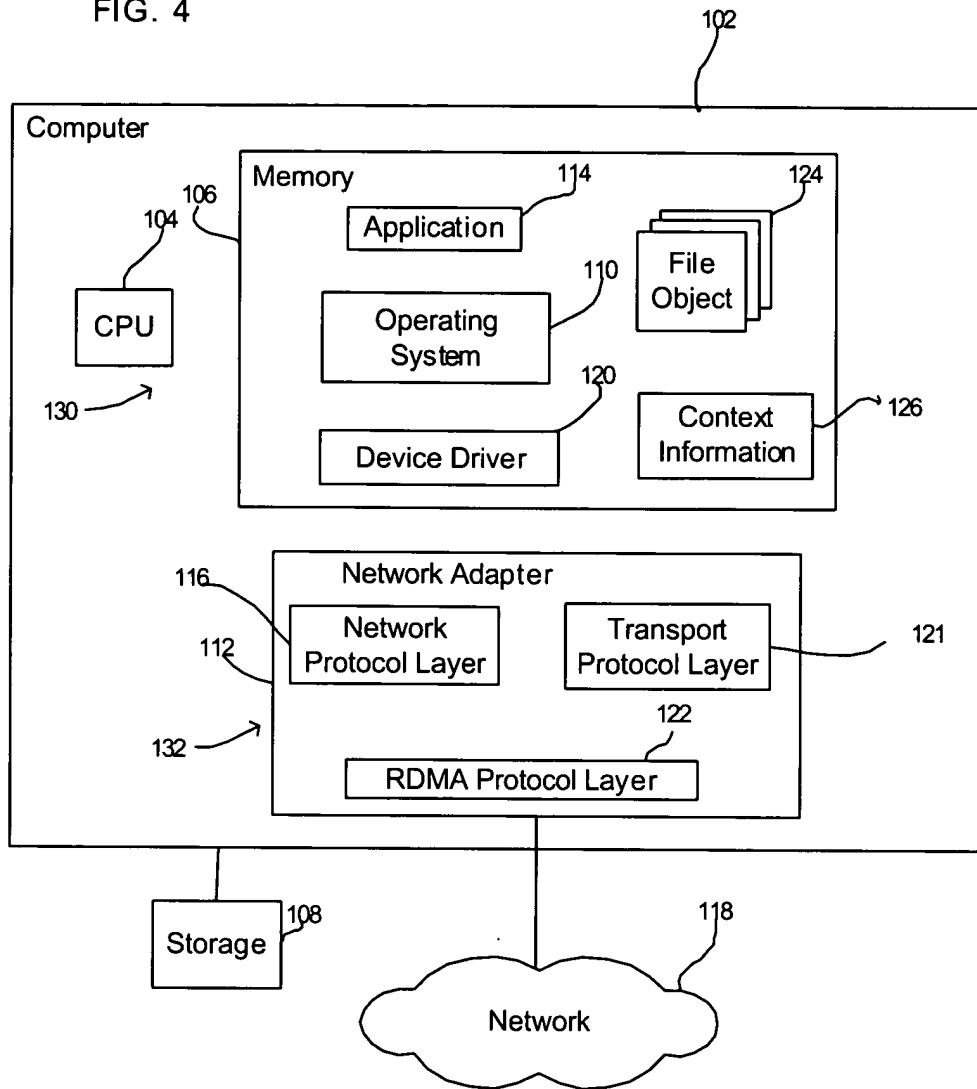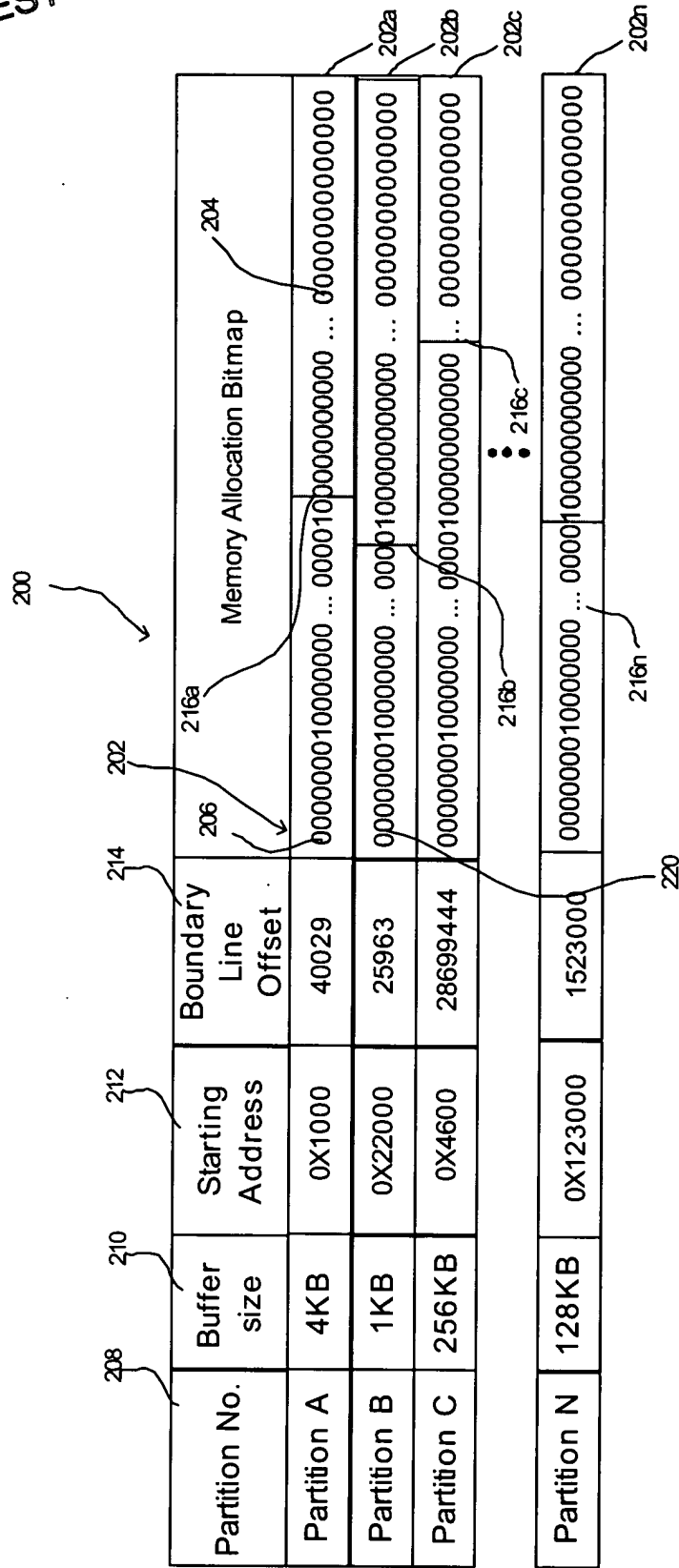
Inventors: Harlan T. Beverly, Docket No. P17601
VIRTUAL MEMORY
METHOD, SYSTEM, AND PROGRAM FOR MANAGING
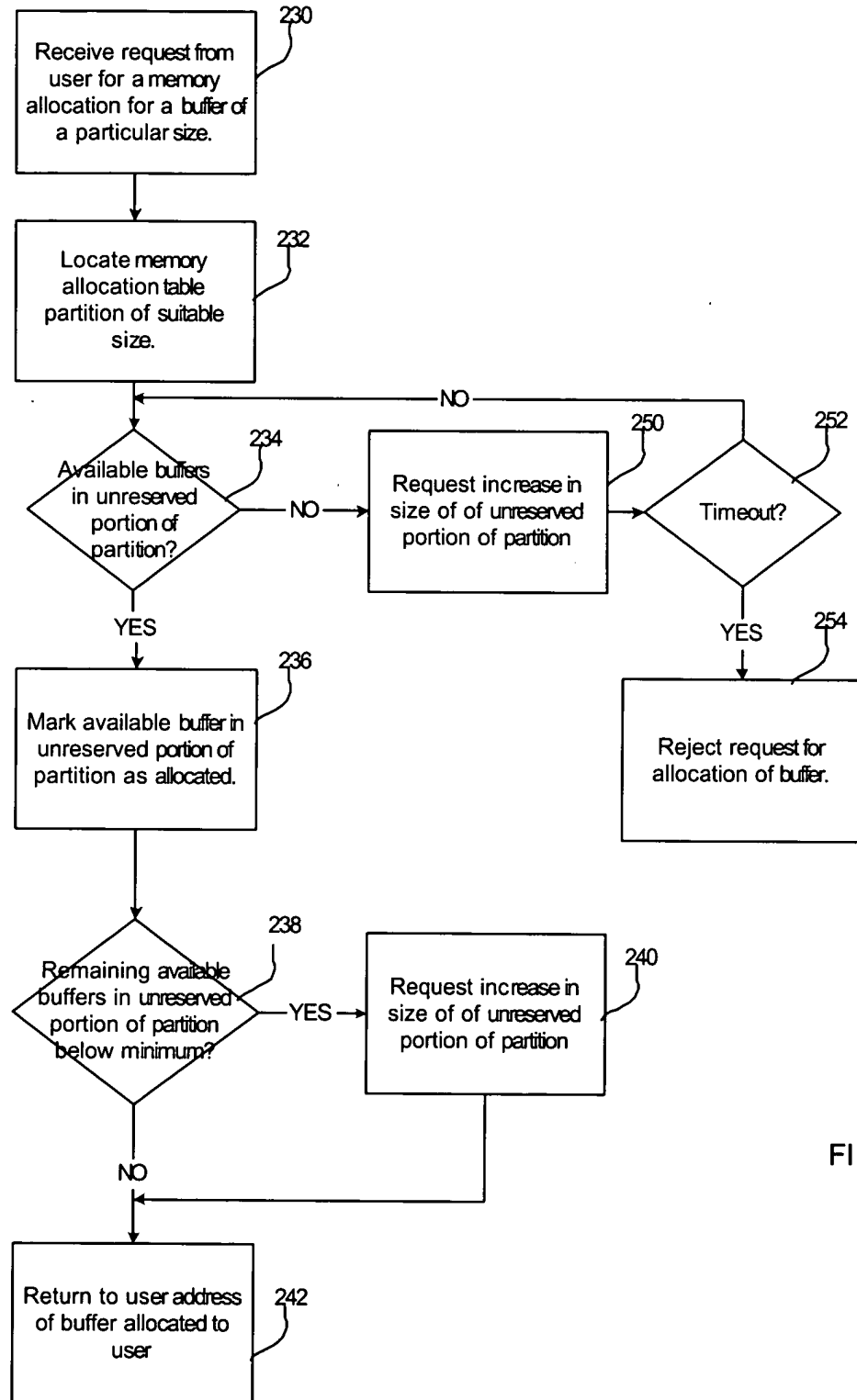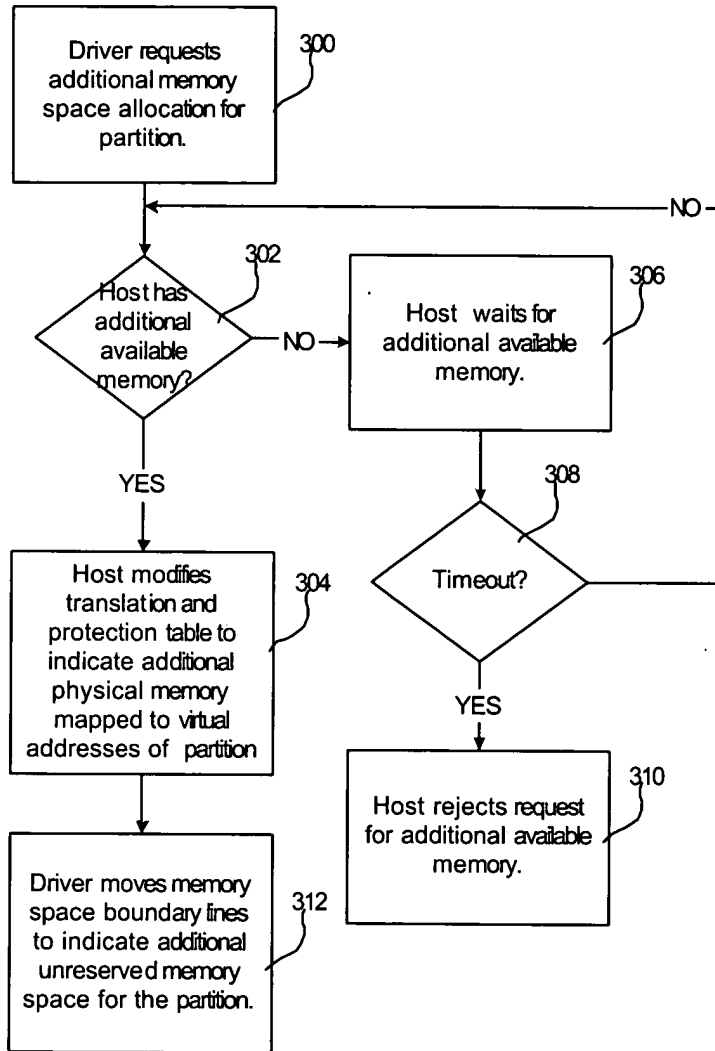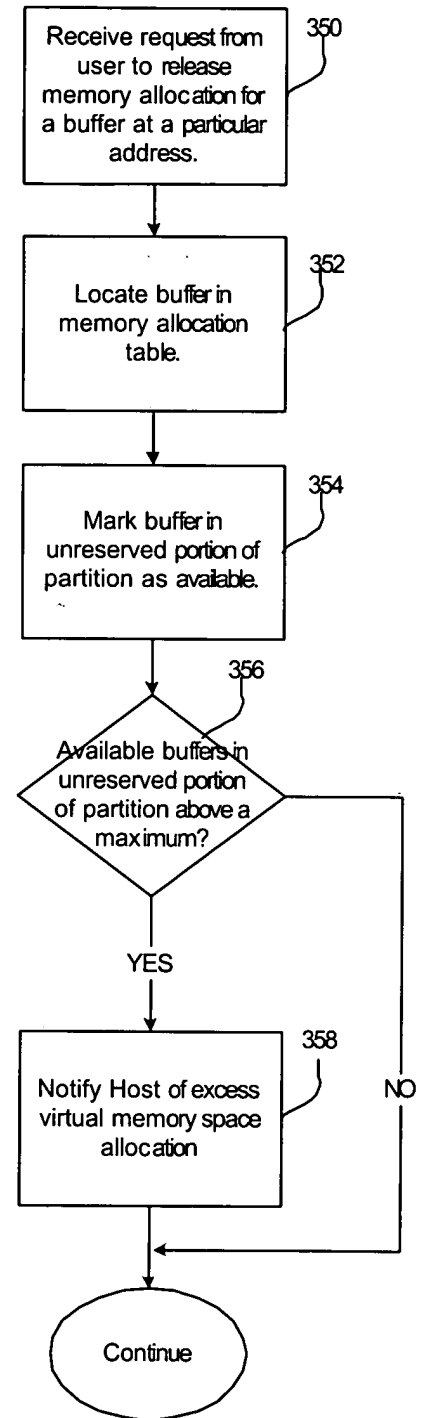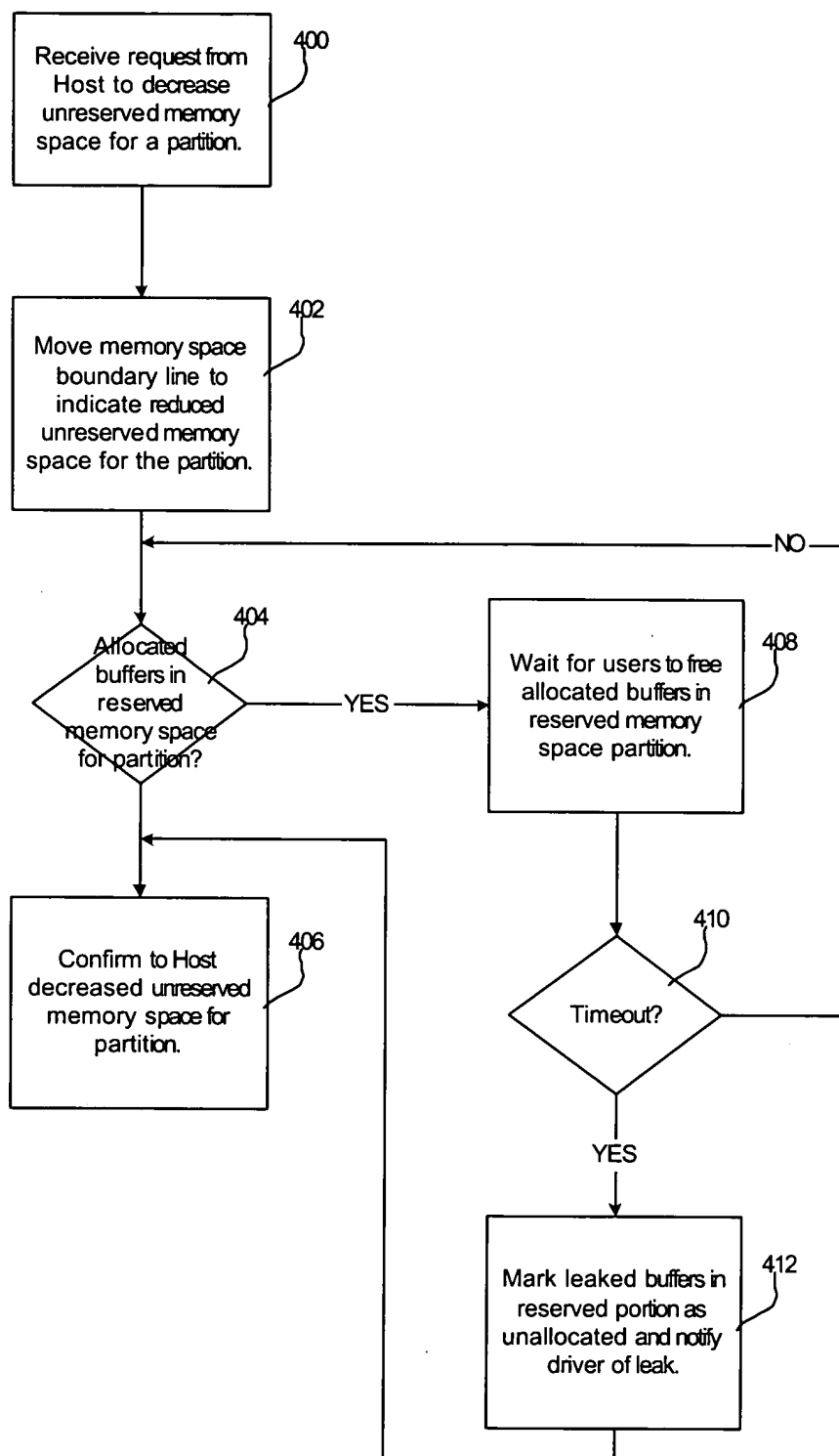
FIG. 4

102

Computer

Memory

114

Application

124

File
Object

104 106

110

CPU

Operating
System

126

130

120

Context
Information

Device Driver

Network Adapter

116

Network
Protocol Layer

Transport
Protocol Layer

121

112

132

122

RDMA Protocol Layer

Storage 108

Network 118

150

Network Packet

Transport Packet

152

Payload Data

154

FIG. 5
Prior Art

Partition No.	Buffer size	Starting Address	Boundary Line Offset	Memory Allocation Bitmap
Partition A	4KB	0X1000	40029	0000000010000000 ... 0000100000000000 0000000000000
Partition B	1KB	0X22000	25963	0000000010000000 ... 0000100000000000 ... 0000000000000
Partition C	256KB	0X4600	28699444	0000000010000000 ... 0000100000000000 ... 0000000000000
Partition N	128KB	0X123000	1523000	0000000010000000 ... 0000100000000000 0000000000000

FIG. 6

Receive request from user for a memory allocation for a buffer of a particular size. 230

Locate memory allocation table partition of suitable size. 232

Available buffers in unreserved portion of partition? 234

Request increase in size of of unreserved portion of partition 250

Timeout? 252

Reject request for allocation of buffer. 254

Mark available buffer in unreserved portion of partition as allocated. 236

Remaining available buffers in unreserved portion of partition below minimum? 238

Request increase in size of of unreserved portion of partition 240

Return to user address of buffer allocated to user 242

FIG. 7

Driver requests additional memory space allocation for partition. 300

Host has additional available memory? 302

NO →

Host waits for additional available memory. 306

NO

Timeout? 308

YES

Host rejects request for additional available memory. 310

YES

Host modifies translation and protection table to indicate additional physical memory mapped to virtual addresses of partition 304

Driver moves memory space boundary lines to indicate additional unreserved memory space for the partition. 312

FIG. 8

Receive request from user to release memory allocation for a buffer at a particular address. 350

Locate buffer in memory allocation table. 352

Mark buffer in unreserved portion of partition as available. 354

Available buffers in unreserved portion of partition above a maximum? 356

YES

Notify Host of excess virtual memory space allocation 358

NO

Continue

FIG. 9

Receive request from
Host to decrease
unreserved memory
space for a partition. — 400

Move memory space
boundary line to
indicate reduced
unreserved memory
space for the partition. — 402

Allocated
buffers in
reserved
memory space
for partition? — 404

—YES—→ Wait for users to free
allocated buffers in
reserved memory
space partition. — 408

Confirm to Host
decreased unreserved
memory space for
partition. — 406

Timeout? — 410

—NO—

Mark leaked buffers in
reserved portion as
unallocated and notify
driver of leak. — 412

YES

FIG. 10

500

Computer Architecture

502

504

Processor

Memory

506

509

Storage

Video
Controller

508

Network
Adaptor

510

512

Input Device

Output
Device

FIG. 11